I CLAIM:

1. A method of figuring a substrate surface comprising the steps of:

    contacting the substrate surface with an etchant solution, wherein an etch rate of the etchant solution increases with temperature; and

    generating a local thermal gradient in each of a plurality of selected local regions of a boundary layer of the etchant solution to imagewise etch the substrate surface in a parallel process.

2. The method as in Claim 1,

    wherein the step of generating a local thermal gradient in each selected local region comprises locally heating each selected local region, whereby the selected local regions etch the substrate surface at higher etch rates than non-selected local regions.

3. The method as in Claim 2,

    further comprising the step of independently controlling the local heating of each selected local region to produce region-specific heating gradients in the boundary layer and thereby imagewise etch the substrate surface at region-specific etch rates.

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4. The method as in Claim 3,

wherein a computer processor is provided to independently control the local heating of each selected local region.

5. The method as in Claim 4,

further comprising the step of interferometrically monitoring the substrate surface to deterministically control the computer processor and the region-specific etch rates.

6. The method as in Claim 5,

wherein the interferometrically monitoring step occurs concurrently with the figuring of the substrate surface.

7. A substrate figured according to the method of Claim 6,

wherein the substrate has a thickness of approximately 50-300 μm and the substrate surface has an OPD flatness of less than $\lambda/10$.

8. The method as in Claim 2,

further comprising the step of macro-cooling the etchant solution to prevent appreciable etching of the substrate surface not due to the local heating of the selected local regions.

9. The method as in Claim 8,

wherein the etchant solution is macro-cooled to a null etch rate, whereby no etching takes place prior to the local heating of the selected local regions.

10. The method as in Claim 8,

wherein the etchant solution is macro-cooled by fluid convection.

11. The method as in Claim 2,

wherein the step of locally heating each selected local region comprises activating a plurality of selected heaters corresponding to the selected local regions and chosen from an indexed array of heaters each locally heating a corresponding local region of the boundary layer upon selective activation thereof.

12. The method as in Claim 11,

further comprising the step of independently controlling the activation of each selected heater to produce region-specific heating gradients in the boundary layer and thereby imagewise etch the substrate surface at region-specific etch rates.

13. The method as in Claim 12,

wherein a computer processor is provided to independently control the activation of each selected heater.

14. The method as in Claim 11,

wherein each heater of the indexed array comprises a pair of electrodes for, upon selective activation thereof, resistively heating a corresponding selected local region and producing a local ionic concentration gradient in the corresponding selected local region to locally etch the substrate surface.

15. The method as in Claim 2,

wherein the step of locally heating each selected local region comprises projecting electromagnetic radiation towards the selected local regions of the boundary layer to locally heat the selected local regions.

16. The method as in Claim 15,

further comprising the step of independently controlling the electromagnetic radiation projected towards each selected local region to imagewise etch the substrate surface at region-specific etch rates.

17. The method as in Claim 16,

wherein a computer processor is provided to independently control the electromagnetic radiation projected towards each selected local region.

18. A method of figuring a substrate surface comprising the steps of:

contacting the substrate surface with an etchant solution, wherein an etch rate of the etchant solution increases with temperature;

activating a plurality of selected heaters corresponding to a plurality of selected local regions of a boundary layer of the etchant solution, and chosen from an indexed array of heaters each for locally heating a corresponding local region of the boundary layer upon selective activation thereof; and

independently controlling by a computer processor the activation of each selected heater, to produce region-specific heating gradients in the selected local regions of the boundary layer and thereby imagewise etch the substrate surface at region-specific etch rates in a parallel process.

19. The method as in Claim 18,

further comprising the step of interferometrically monitoring the substrate surface to deterministically control the computer processor and the region-specific etch rates.

20. The method as in Claim 19,

wherein the interferometrically monitoring step occurs concurrently with the figuring of the substrate surface.

21. A substrate figured according to the method of Claim 19,

wherein the substrate has a thickness of approximately 50-300 μm and the substrate surface has an OPD flatness of less than $\lambda/10$.

22. The method as in Claim 18,

further comprising the step of macro-cooling the etchant solution to prevent appreciable etching of the substrate surface not due to the local heating of the selected local regions.

23. The method as in Claim 22,

wherein the etchant solution is macro-cooled to a null etch rate, whereby no etching takes place prior to the local heating of the selected local regions.

24. The method as in Claim 22,

wherein the etchant solution is macro-cooled by fluid convection.

25. The method as in Claim 18,

wherein each heater of the indexed array comprises a pair of electrodes for, upon selective activation thereof, resistively heating a corresponding selected local region and producing a local ionic concentration gradient in the corresponding selected local region to locally etch the substrate surface.

26. A method of figuring a substrate surface comprising the steps of:

contacting the substrate surface with an etchant solution, wherein an etch rate of the etchant solution increases with temperature;

projecting electromagnetic radiation towards selected local regions of a boundary layer of the etchant solution to locally heat the selected local regions; and

independently controlling by a computer processor the electromagnetic radiation projected towards each selected local region, to produce region-specific heating gradients in the boundary layer and thereby imagewise etch the substrate surface at region-specific etch rates in a parallel process.

27. The method as in Claim 26,

wherein the projected electromagnetic radiation is directed on a heatable material in conductive contact with the boundary layer of the etchant solution to thereby transfer heat to the selected local regions.

28. The method as in Claim 26,

further comprising the step of interferometrically monitoring the substrate surface to deterministically control the computer processor and the region-specific etch rates.

29. The method as in Claim 28,

wherein the interferometrically monitoring step occurs concurrently with the figuring of the substrate surface.

30. A substrate figured according to the method of Claim 28,

wherein the substrate has a thickness of approximately 50-300 μm and the substrate surface has an OPD flatness of less than $\lambda/10$.

31. The method as in Claim 26,

further comprising the step of macro-cooling the etchant solution to prevent appreciable etching of the substrate surface not due to the local heating of the selected local regions.

32. The method as in Claim 31,

wherein the etchant solution is macro-cooled to a null etch rate, whereby no etching takes place prior to the local heating of the selected local regions.

33. The method as in Claim 31,

wherein the etchant solution is macro-cooled by fluid convection.

34. A system for figuring a substrate surface in contact with an etchant solution having an etch rate which increases with temperature, said system comprising:

means for generating a local thermal gradient in each of a plurality of selected local regions of a boundary layer of the etchant solution to imagewise etch the substrate surface in a parallel process.

35. The system as in Claim 34,

wherein the means for generating a local thermal gradient in each selected local region comprises means for locally heating each selected local region of the boundary layer of the etchant solution, whereby the selected local regions etch the substrate surface at greater local etch rates than non-selected local regions.

36. The system as in Claim 35,

further comprising means for independently controlling the means for locally heating each selected local region, to produce region-specific heating

gradients in the boundary layer and thereby imagewise etch the substrate surface at region-specific etch rates.

37. The system as in Claim 36,

wherein the means for independently controlling the means for locally heating each selected local region comprises a computer processor.

38. The system as in Claim 37,

further comprising an interferometer for monitoring the substrate surface so as to deterministically control the computer processor and the region-specific etch rates.

39. The system as in Claim 38,

wherein the interferometer monitors the substrate surface concurrently with the figuring of the substrate surface.

40. The system as in Claim 35,

further comprising means for macro-cooling the etchant solution to prevent appreciable etching of the substrate surface not due to the local heating of the selected local regions.

41. The system as in Claim 40,

wherein the means for macro-cooling the etchant solution maintains a null etch rate of the etchant solution, whereby no etching takes place prior to the local heating in the selected regions of the boundary layer.

42. The system as in Claim 40,

wherein the means for macro-cooling the etchant solution prevents appreciable etching of the substrate surface by fluid convection.

43. The system as in Claim 35,

wherein the means for locally heating each selected local region of the boundary layer comprises an indexed array of heaters each for locally heating a corresponding local region of the boundary layer upon selective activation thereof, whereby activation of a plurality of selected heaters locally heats a plurality of corresponding selected local regions of the boundary layer; and

44. The system as in Claim 43,

further comprising means for independently controlling the activation of each selected heater, to produce region-specific heating gradients in the boundary layer and thereby imagewise etch the substrate surface at region-specific etch rates.

45. The system as in Claim 44,

wherein the means for independently controlling the selective activation of each heater comprises a computer processor.

46. The system as in Claim 43,

wherein each heater of the indexed array comprises a pair of electrodes for, upon selective activation thereof, resistively heating a corresponding selected local region and producing a local ionic concentration gradient in the corresponding selected local region to locally etch the substrate surface.

47. The system as in Claim 35,

wherein the means for locally heating each selected local region of the boundary layer comprises a projector for projecting electromagnetic radiation towards the selected local regions to locally heat the selected local regions.

48. The method as in Claim 47,

further comprising means for independently controlling the electromagnetic radiation projected towards each selected local regions, for imagewise etching the substrate surface at region-specific etch rates.

49. The system as in Claim 48,

wherein the means for independently controlling the electromagnetic radiation projected towards each selected local region comprises a computer processor.

50. A system for figuring a substrate surface in contact with an etchant solution having an etch rate which increases with temperature, said system comprising:

an indexed array of heaters each for locally heating a corresponding local region of a boundary layer of the etchant solution upon selective activation thereof, whereby activation of a plurality of selected heaters causes a plurality of corresponding selected local regions of the boundary layer to locally etch the substrate surface at greater local etch rates than non-selected local regions; and

a computer processor for independently controlling the activation of each selected heater, to produce region-specific heating gradients in the selected local regions of the boundary layer and thereby imagewise etch the substrate surface in a parallel process at region-specific etch rates.

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51. The system as in Claim 50,

further comprising an interferometer for monitoring the substrate surface so as to deterministically control the computer processor and the region-specific etch rates.

52. The system as in Claim 51,

wherein the interferometer monitors the substrate surface concurrently with the figuring of the substrate surface.

53. The system as in Claim 50,

further comprising means for macro-cooling the etchant solution to prevent appreciable etching of the substrate surface not due to the local heating in the selected local regions of the boundary layer.

54. The system as in Claim 53,

wherein the means for macro-cooling the etchant solution maintains a null etch rate of the etchant solution, whereby no etching takes place prior to the local heating in the selected regions of the boundary layer.

55. The system as in Claim 53,

wherein the means for macro-cooling the etchant solution prevents appreciable etching of the substrate surface by fluid convection.

56. The system as in Claim 50,

wherein the indexed array of heaters is submerged in the etchant solution.

57. The system as in Claim 50,

wherein the indexed array of heaters is proximately spaced from a substrate surface placed in contact with the etchant solution, whereby the boundary layer is substantially thin to minimize lateral thermal dispersion between local regions of the boundary layer.

58. The system as in Claim 50,

wherein each heater of the indexed array comprises a pair of electrodes for, upon selective activation thereof, resistively heating a corresponding selected local region and producing a local ionic concentration gradient in the corresponding selected local region to locally etch the substrate surface.

59. A system for figuring a substrate surface in contact with an etchant solution having an etch rate which increases with temperature, said system comprising:

a projector for projecting electromagnetic radiation towards selected local regions of a boundary layer of the etchant solution to locally heat the selected local regions; and

a computer processor for independently controlling the electromagnetic radiation projected towards each selected local region, to produce region-specific heating gradients in the boundary layer and thereby imagewise etch the substrate surface in a parallel process at region-specific etch rates.

60. The system as in Claim 59,

further comprising a heatable material in conductive contact with the boundary laver of the etchant solution, wherein upon incidence thereon of the projected electromagnetic radiation the heatable material transfers heat to the selected local regions.

61. The system as in Claim 59,

further comprising an interferometer for monitoring the substrate surface so as to deterministically control the computer processor and the region-specific etch rates.

62. The system as in Claim 61,

wherein the interferometer monitors the substrate surface concurrently with the figuring of the substrate surface.

63. The system as in Claim 59,

further comprising means for macro-cooling the etchant solution to prevent appreciable etching of the substrate surface not due to the local heating in the selected local regions of the boundary layer.

64. The system as in Claim 63,

wherein the means for macro-cooling the etchant solution maintains a null etch rate of the etchant solution, whereby no etching takes place prior to the local heating in the selected regions of the boundary layer.

65. The system as in Claim 63,

wherein the means for macro-cooling the etchant solution prevents appreciable etching of the substrate surface by fluid convection.